Canada's Dynamic Coastline geo*facts*

Nova Scotia Department of Natural Resources
Mineral Resources Branch
Information Circular ME 29, 1992

Table of Contents

- How long is Canada's coastline?
- Why is our coastline important?
- What is erosion?
- What causes erosion?
- What causes the sea level to rise?
- How fast is our coastline retreating?
- Can coastal erosion be prevented?
- Information

Back to Top

How long is Canada's coastline?

If you were to try to walk around Canada, following the coastline at a good pace of 20 kilometres each day, it would take you 33 years to complete the journey. At 243 000 kilometres, Canada's coastline is the longest in the world. Of course, to go from the Strait of Juan de Fuca to the Bay of Fundy, you would have to walk in and out of the fjords of British Columbia, along the frozen tundra of the Yukon and Northwest Territories not to mention across pack ice to take in the myriad Arctic Islands, back through the fjords of Labrador, ad in and out of every little fishing cove in Atlantic Canada.

Along the way you would border three oceans and see many different kinds of coastline. Some of our coasts are dominated by hard bedrock that forms towering cliffs and rocky shorelines. Other areas have lower cliffs made of sand, gravel and mud. You would walk along sand beaches, cobble beaches and mud flats. You would have to struggle across marshes, sand dunes and river deltas. It may well take you longer than 33 years.

Back to Top

Why is our coastline important?

Every year, Canadians invest about $1 billion on projects related to our coasts. The funds are used to maintain ports and harbours, for erosion protection, pollution control and aquaculture, and for recreation facilities. A valuable investment when you consider that about

one-third or Canada's Gross National Product (GNP) is generated by activities that in one way or another - use the coastline either directly or as a transportation route.

Beyond that, our coasts provide important habitats to hundreds of species of birds and wildlife. Some of the world's largest natural wetlands, such as the Mackenzie Delta and Hudson Bay, are found in Canada's coastal regions.

These are some of the factors that explain why the Geological Survey of Canada (GSC) is so interested in studying our coastline and the many processes that affect it. Scientists are trying to understand the causes and rates of erosion, and how sediment is transported and deposited within the coastal zone, and what can be done to manage this natural resource. Nova Scotia Department of Mines and Energy.

Back to Top

What is erosion?

Erosion is the process by which material is removed from cliffs and beaches, causing the coastline to retreat inland. It is a natural process that occurs along many parts of the coast. The mud, sand and gravel that are removed by erosion are transported along the coast by waves and currents, to be deposited on beaches and other landforms such as spits and barrier islands. Some of the material ends up on the seabed or in estuaries and bays, thereby resupplying and maintaining marshes.

If the coastline is left unprotected, homes, businesses and public buildings built along the shore may be undermined by erosion. At times - especially during severe storms - erosion can even damage wharfs, seawalls and breakwaters that were built to protect coastal communities.

Back to Top

What causes erosion?

Many factors cause erosion, and they vary from place to place around the country. In most regions, the pounding of waves on the shoreline, especially during storms, is an important cause. Waves attack cliffs at the base and transport the eroded material away, exposing deeper sections of the cliff to erosion. If there is insufficient sediment to replace the material carried away from a shoreline, the shore will retreat or change shape so that it can better maintain its position against natural processes such as wave action. Storm waves cause erosion of sand and gravel from beaches, but the material is often returned to the beach during fair weather.

In the Arctic, the sea is frozen for most of the year, meaning that waves are not usually a factor. But movement of the ice itself can scrape against the coast, causing erosion. Also, where the Arctic ground is frozen, cliffs can be eroded by the melting of the permafrost and resulting slumping of the shoreline.

Another important cause of erosion is a rise in sea level which exposes new land to wave attack. If insufficient new sediment is added to the coast during a rise in the sea level, the rate of inland retreat will likely increase.

Back to Top

What causes the sea level to rise?

The short answer is "ice", but it has caused two quite different effects, both of which are visible on Canada's coasts.

More than 10,000 years ago, the world was largely under the influence of an Ice Age. Much of the northern hemisphere was covered by ice, kilometres thick. The ice had formed from water from the world's oceans, and in the process, the level of the oceans had dropped by more than 100 metres. As the Ice Age came to an end and the ice began to melt, the water was returned to the oceans which again began to rise. To a small extent, this process is still happening, and can be perceived in areas such as Nova Scotia.

In Canada, where much of the ice was to be found during the Ice Age, another factor is important. The weight of the ice actually depressed the Earth's crust; with the weight now removed, the land is rebounding to its original position. Examples of the resulting terraced coastlines can be found in the Arctic, where the rebounding makes the sea level appear to be dropping, instead of rising.

There is one further factor to be considered: because we are adding large volumes of carbon dioxide and other gases to the atmosphere, scientists estimate that it is beginning to heat up faster as a result of the greenhouse effect. The warming effect may be accelerating the rate of melting of the remaining ice caps in Greenland and the Antarctic. The prediction is that the sea level will start to rise at a faster rate over the next century, and that many areas of Canada - and the rest of the world - will be subjected to increased risk of coastal erosion.

Back to Top

How fast is our coastline retreating?

First, we must remember that not all parts of the country are experiencing a rising sea level. Most of the eastern Arctic, Quebec and Newfoundland are, in fact, experiencing a falling sea level, and erosion is less likely to occur in these regions.

In the remainder of the Atlantic region, including most of Nova Scotia, the sea level is rising. It appears it is also rising in the Beaufort Sea, off the Yukon and Northwest Territories. In both regions, GSC scientists' have been monitoring selected shorelines to measure the effect of waves, currents, winds and sea ice, and the rates at which different types of shores respond to different processes. For example, recent monitoring of two beaches on the Eastern Shore of Nova Scotia has shown the differences in coastal change: one low beach has been retreating landward at a rate of eight metres a year, whereas a higher-crested beach a few kilometres away shows little retreat.

Obviously, in areas where the coastline is rocky, the rate of retreat is barely noticeable over historical time. In other areas, where the coast is composed of loose sand, gravel and mud, the rate of retreat is much higher. In Atlantic Canada, rates of erosion can reach up to 10 metres per year, but are generally less than one metre per year. Historical records show the loss of entire islands along the coast of Nova Scotia. Along the Beaufort Sea, the average rate of retreat is generally a little higher, being between one and two metres per year.

Back to Top

Can coastal erosion be prevented?

Coastal protection is, as we have seen, a very expensive business. But it can be done in order to protect important installations such as ports, harbours and major highways. In many cases where this has been tried in the past, the protection has proven less than adequate.

With the increased risk of coastal erosion posed by greenhouse warming, there is a greater need than ever for Canada to understand and manage the development of our coastlines. Pressures of conflicting land use are expected to increase over the coming years. In order to allow for better design of structures and more responsible management of the coastal zone, it is necessary to understand the geological an oceanographic processes operating in them.

Scientists from the GSC, working to understand these processes, have introduced a new Marine Environmental Geoscience Initiative, led by the Atlantic Geoscience Centre in Dartmouth, Nova Scotia. Understanding the physical framework and the response of a particular coast to natural processes will help prevent costly errors in planning and locating structures and facilities in the coastal zone, and reduce their vulnerability to erosion, with the resulting loss of public property.

Back to Top

Information

For further information on minerals, mining, and geological research in Nova Scotia, please contact:

Nova Scotia Department of Natural Resources Library
Third Floor, Founders Square
1701 Hollis Street, P. O. Box 698
Halifax, Nova Scotia
B3J 2T9

Telephone: 902-424-8633
FAX: 902-424-7735
E-mail: nsdnrlib@gov.ns.ca

Back to Top

Photos: (Not presently available)

The coastline acts as a natural buffer for the land against the sea. Beaches and sand bars are constantly changing in response to waves such as those shown here pounding on the Magdalen Islands, Quebec, (photo by E. H. Owens)

During storms, particularly those which coincide with high water levels, shores are rapidly eroded, flooded and property is damaged. Such was the case in 1983 when a storm surge struck Neils Harbour, Nova Scotia pushing the beach landward and destroying buildings which had stood for more than 90 years. (photo by R. B. Taylor).

Sediment erodes from coastal cliffs supplies sand and gravel for the building of adjacent beaches and finer material for the growth of tidal flats and salt marches in coastal estuaries. Scientist from the Geological Survey of Canada are monitoring the rates of cliff retreat and the dispersion of sediment within the coastal zone.

Back to Top

Figure: (Not presently available)

Not all parts of the Canadian coastline are experiencing a rising sea level. Tidal records from this century from Churchill, Manitoba where relative sea level is falling and Halifax, Nova Scotia where relative sea level is rising illustrate extreme contrasts found along the Canadian coastline.

Back to Top

Mineral Resources Branch Home Page Natural Resources Home Page

GOV'T. INDEX

The contents of this site are best viewed with an enhanced browser such as Microsoft® Internet Explorer® or Netscape® Navigator®.

Comments and questions about this web site.
This page and all contents are copyright 2001-2005
Mineral Resources Branch,
Department of Natural Resources,
Province of Nova Scotia,
all rights reserved.
Page last updated June 3, 2005.

Privacy Policy: http://gov.ns.ca/govt/privacy/privacypolicy.HTM